

# Omar Alhussein

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## Education

- Jan2016 - Apr2020 **PhD in Electrical Engineering (Communications and Information Systems),**  
*University of Waterloo, ON, Canada*  
Thesis: Joint Composition, NF Placement, Routing for NFV-enabled Services  
Advised by: Weihua Zhuang  
GPA: 89/100  
Notable courses: Stochastic processes, Intro to optimization, Wireless commun. networks.
- May2014 - Aug2015 **MASc in Engineering Science,**  
*Simon Fraser University, BC, Canada*  
Thesis: Performance Analysis of Wireless Fading Channels: A Unified Approach  
Advised by: Jie Liang, and Sami Muhaidat  
GPA: 4.22/4.33  
Notable courses: Machine learning, Linear systems theory, Advanced digital communications.
- Sep2008 - Aug2013 **BSc in Telecommunication Engineering,**  
*Khalifa University, Abu Dhabi, United Arab Emirates*  
GPA: 3.53/4.0.

## Research Interests

Networking, Machine Learning, Wireless Communications, & Optimization.

## Work Experience

### Research

- Jun2020 - present **Senior Research Engineer, Huawei Technologies Canada, Ottawa, Canada.**
- Working with the advanced networking team.
  - Researching native machine learning-based solutions for next-generation networks.
  - Participating with internal team and providing recommendations.
  - Collaborating with academic teams on research projects.
  - Submitted two patents on probabilistic AI in networking and AI trustworthiness, with others in the pipeline.
  - Received technology spotlight award in April 2021.
  - Received Ottawa wireless department spotlight award in August 2021.
- Jan2016 - Apr2020 **Doctoral Research, University of Waterloo, Waterloo, Canada.**
- Developed a model-free data-driven method, using deep reinforcement learning, to compose and orchestrate abstract network services with time-varying traffic requirements onto the network substrate. A main result is using model-based solution with a vanilla DRL aids in the exploration process especially in conflicting and sparse reward environments.
  - Developed an online competitive algorithm for multicast services with mandatory and best-effort NFs. The algorithm is designed using a primal-dual based approach, and it offers generalized and alternative description to existing relevant works. Results published in IEEE JSAC.
  - Formulated an optimal joint traffic routing and NF placement for multicast services. Developed heuristic algorithm to decrease the complexity of the NP-hard problem. Published in IEEE JSAC and Globecom.
  - Link to thesis: <http://hdl.handle.net/10012/15850>
- May2014 - Aug2015 **MASc Research, Simon Fraser University, Vancouver, Canada.**
- Adopted two tractable mixture distributions, namely mixture of Gaussian and mixture of Gamma, to approximate various (composite) fading channels using the expectation-maximization and variational Bayes algorithms.
  - Conducted performance analyses over various composite fading channels (using the mixture distributions) in several environments, such as cognitive radio networks, and impulsive noise environments.
  - Results were published in seven conf/journal papers.
  - Link to thesis: <http://summit.sfu.ca/item/15696>

- Dec2013 - May2014 **Research Assistant**, *Etisalat British Telecom Innovation Centre*, Abu Dhabi.  
 o Developed a data reduction pre-processing technique for large datasets to be used in machine learning classifiers. Several papers were published. Was advised by Paul. D. Yoo & Kin Poon.
- Teaching**
- Jan2018 - May2019 **Graduate Teacher Assistant**, *University of Waterloo*,  
 Digital communications (ECE 318), and Communication networks (ECE 358).
- Jan2015 - May2015 **Graduate Teacher Assistant**, *Simon Fraser University*,  
 Introduction to engineering analysis (ENSC 180), and linear systems (ENSC 380).
- Jan2010 - May2012 **Science Communicator (part-time)**, *Khalifa University Intel Discovery Center*, Abu Dhabi.  
 Presented computing and communication technologies to stimulate/inspire school kids.
- May2009 - Jun2009 **Teacher assistant and supervisor**, *Institute of Applied Technology*, Abu Dhabi.  
 Served as a teacher assistant and supervisor in a summer school for primary school students.
- Other**
- Jun2012 - Nov2012 **Internship**, *ELKO TGS*, Ankara, Turkey.  
 Involved in the design/analysis of circuit breakers, various electrical tests, and studying feasibility of initiating SCADA communication system for the company. Tasks included optimizing company's network and its security.
- Jan2010 - May2013 **Supervisor/invigilator (part-time)**, *IETLS Outreach Centre, British Council*, UAE.  
 Participated in a mobile team to carry IELTS examinations in different places. Started off as a marshal and was promoted to invigilator and then supervisor in very short-time.

## Patents

- networking, DL Patent on the use of probabilistic DL for traffic engineering is submitted.
- DRL, Patent on securing deep reinforcement learning models from theft is submitted.
- AI Trustworthiness

## Publications

### Articles under review

- NFV, DRL **O. Alhussein**, and W. Zhuang, "Dynamic Topology Design of NFV-enabled Services using Deep Reinforcement Learning," *submitted to IEEE Trans. Cognitive Comm. Netw.*

### Peer-reviewed articles

- trust management, IoT M. Ben-Yahya, **O. Alhussein**, and X. Shen, "Securing Software-defined WSNs Communication via Trust Management," *IEEE Internet of Things J.*, pp. 1–1, 2021.
- NFV, **O. Alhussein**, and W. Zhuang, "Robust online composition, routing and NF placement for NFV-enabled services," *IEEE J. Sel. Areas Commun.*, vol. 38, no. 6, pp. 1089–1101, 2020.
- competitive analysis NFV, **O. Alhussein**, P. T. Do, J. Li, W. Shi, W. Zhuang, and X. Shen, "A Virtual Network Customization Framework for Multicast Services in NFV-Enabled Core Networks," *IEEE J. Sel. Areas Commun.*, vol. 38, no. 6, pp. 1025–1039, 2020.
- multicast routing **O. Alhussein**, P. D. Yoo, S. Muhaidat, Jie Liang, "Efficient subsampling framework of very large datasets in machine learning," in *Proc. IEEE CCECE*, 2019, pp. 1-6.
- ML, subsampling M. Li, **O. Alhussein**, P. Sofotasios, S. Muhaidat, P. D. Yoo, J. Liang, and A. Wang, "Censor-based cooperative multi-antenna spectrum sensing with imperfect reporting channels," *IEEE Trans. Sustainable Comput.*, vol. 05, no. 01, pp. 48-60, 2019.
- wireless, fading, spectrum sensing **O. Alhussein**, P. T. Do, J. Li, Q. Ye, W. Shi, W. Zhuang, X. Shen, X. Li, and J. Rao "Joint VNF placement and multicast traffic routing in 5G core networks," in *Proc. IEEE GLOBECOM*, 2018, pp. 1-6.
- NFV, multicast routing M. Wahbah, **O. Alhussein**, et al., "Evaluation of parametric statistical models for wind speed probability density estimation," in *IEEE Proc. EPEC*, 2018, pp. 1-6.
- mixture Gaussian SDN, N. Zhang, S. Zhang, P. Yang, **O. Alhussein**, W. Zhuang, and X. Shen, "Software defined space-air-ground integrated vehicular networks: Challenges and solutions," *IEEE Comm. Magazine*, vol. 55, no. 7, pp. 101–109, 2017.
- space-air-ground impulsive noise, generalized fading **O. Alhussein**, I. Ahmed, J. Liang, S. Muhaidat. "Unified analysis of diversity reception in the presence of impulsive noise," *IEEE Trans. Vehicul. Technol.*, vol. 66, no. 2, pp. 1408–1417, 2017.

cooperative spectrum sensing A. Al Hammadi, **O. Alhussein**, P. C. Sofotasios, S. Muhaidat, M. Al- Qutayri, S. Al-Araji, G. K. Karagiannidis, and J. Liang, "Unified Analysis of cooperative spectrum sensing over composite and generalized fading channels," IEEE Trans. Vehicul. Techn., vol. 65, no. 9, pp. 6949–6961, 2016.

ML O. Al-Jarrah, **O. Alhussein**, P. D. Yoo, S. Muhaidat, K. Taha, and K. Kim, "Data randomization and cluster-based partitioning for botnet intrusion detection," IEEE Tran. Cybern., vol. 46, no. 8, pp. 1796–1806, 2016.

wireless, fading model B. Selim, **O. Alhussein**, S. Muhaidat, G. K. Karagiannidis, and J. Liang, "Modeling and analysis of wireless channels via the mixture of gaussian distribution," IEEE Trans. Vehicul. Techn., vol. 65, no. 10, pp. 8309–8321, 2016.

ML, botnet R. Baiad, **O. Alhussein**, H. Otrok, and S. Muhaidat, "Novel cross layer detection schemes to detect blackhole attack against QoS-OLSR protocol in VANET," Vehicular Commun., vol. 5, pp. 9–17, 2016.

Mixture gamma, diversity analysis **O. Alhussein**, A. Hammadi, P. C. Sofotasios, S. Muhaidat, J. Liang, M. Alqutayri, G. K. Karagiannidis, "Performance analysis of energy detection over mixture gamma based fading channels with diversity reception," in Proc. IEEE Wimob, 2015, pp. 399–405.

ML F. Adly, **O. Alhussein**, P. D. Yoo, S. Muhaidat, and Y. Al-Hammadi, "Simplified subspace regression network for identification of defect patterns in semiconductor wafer maps," IEEE Trans. Ind. Informat., vol. 11, no. 6, pp. 1267–1276, 2015.

mixture Gaussian model **O. Alhussein**, B. Selim, T. Assaf, S. Muhaidat, G. K. Karagiannidis, and J. Liang, "A generalized mixture of gaussians for fading channels," In Proc. IEEE VTC, 2015, pp. 1–6.

spectrum sensing, fading B. Selim, **O. Alhussein**, G. K. Karagiannidis, and S. Muhaidat, "Optimal cooperative spectrum sensing over composite fading channels," in Proc. IEEE ICC, 2015, pp. 520–525.

EM, fading **O. Alhussein**, S. Muhaidat, J. Liang, and P. D. Yoo, "A unified approach for representing wireless channels using EM-based finite mixture of gamma distributions," in Proc. Globecom Workshops, 2014, pp. 1008–1013.

OFDM, SDR **O. Alhussein**, R. Mahmoud, K. Eledlebi, and Z. Sead, "Spectrum sensing techniques for OFDM-based cognitive radio networks," in Terena Netw. Conf., 2013, *Indexed poster*.

ML K. Alromaithi, **O. Alhussein**, and P. D. Yoo, "An intelligent system for protein structure prediction," in Undergraduate Research Conf. Applied Comput., Zayed University, 2012, *Poster*.

S. Azzeh, **O. Alhussein**, and S. A. Abusamra, "A mathematical model to decrease obesity in the UAE," in Proc. ASME IMECE, 2011, pp. 385–390.

## Current Supervision

- Jan 2020 - present Abubakar Sani Ali, [Visible Light Communications](#), pursuing Ph.D. at Khalifa University. Co-supervision with Sami Muhaidat.
- Jan 2020 - present Esraa Mohammed Ghourab, [Physical-Layer Techniques for the Next Generation Wireless Networks](#), pursuing Ph.D. at Khalifa University. Co-supervision with Sami Muhaidat.
- Jan 2021 - present Khalid AlHamdani, [Ambient Backscatter Communications](#), pursuing MSc. at Khalifa University. Co-supervision with Sami Muhaidat.

## Technical Skills

- Sim. & Math Tensorflow, Matlab, Mathematica, R, Prosim F32, Weka
- Programming Python, C++, Git
- Networking Mininet, Wireshark, NMAP, OpenFlow

## Pedagogical Training

- May2021 - Sep2021 Passed an online course from the University of Hong Kong on the fundamentals of university teaching.
- 2019-2020 Attended six seminars at the University of Waterloo that covered various topics: (a) teaching methods, (b) effective lesson plans, (c) classroom delivery skills, (d) student's beliefs about learning, and (e) providing quality feedback.

## Honors and Awards

- Aug2021 Awarded wireless department spotlight award in Huawei Technologies Canada, Ottawa.

Apr2021 Awarded technology spotlight award in Huawei Technologies Canada, Ottawa.  
 Sep2019 Awarded University of Waterloo Graduate Scholarship (\$1500).  
 Sep2019 Awarded Xuemin Shen graduate scholarship in communications (\$1000).  
 May2019 Awarded University of Waterloo Graduate Scholarship (\$1500).  
 Jan2016 Awarded faculty of engineering graduate scholarship, University of Waterloo (\$1500).  
 Sep2015 Awarded four-year graduate fellowship that was not claimed, Simon Fraser University (\$200,000)  
 Jan2014 - Aug2015 Awarded graduate fellowship, Simon Fraser University (\$6250).  
 Jan2014 - Aug2015 Awarded full graduate fellowship, Simon Fraser University (\$6250).  
 Sep2008 - Aug2013 Awarded full undergraduate scholarship, Khalifa University (\$172,822.74).  
 May2012 Won first place at the ASME rapid design challenge, District J. Development Conference at the Lebanese American University.  
 2009-2011 Represented school at gulf/national programming contests (NPC2009, NPC2010, GPC2011).  
 2010-2010 First place at university programming contest, Khalifa University (\$200).  
 2010-2010 Second place at the engineering design competition, IEEE-UAE Student Day (\$200).

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## Service

2013-present Regular Reviewer for IEEE Commun. Lett., IEEE Tran. Veh. Techn., IEEE Proc. Globecom, & many other journals and conferences.  
 2010-2012 Vice Chair, IEEE Student Chapter, Khalifa University.  
 2010-2011 Engineering Section Editor, Student Voice Newsletter, Khalifa University.

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## Other Interests

Swimming and Free-diving (Licensed AIDA-2, personal record: 3m45s static apnea).  
 Traveling (mostly occasional weekend escapades, and event travels).